## II B.Tech - II Semester – Regular / Supplementary Examinations MAY - 2023

## APPLIED THERMODYNAMICS (MECHANICAL ENGINEERING)

Duration: 3 hours

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.

2. All parts of Question must be answered in one place.

BL – Blooms Level

1

CO – Course Outcome

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Max. Marks: 70

			BL	CO	Max.
					Marks
		UNIT-I			
1	a)	How do you compare SI and CI Engines?	L1	CO1,	7 M
		How do you compare SI and CI Engines?		CO2	
	b)	Explain i)swept volume, ii)clearance	L2	CO2	7 M
		volume, iii)mean effective pressure, iv)top			
		and bottom dead centers v)torque			
		OR			
2	a)	Define brake power and explain how it is	L2	CO2	3 M
		measured.			
	b)	A four stroke petrol engine with a	L2	CO2	11 M
		compression ratio of 8:1 and total piston			
		displacement of $5.2 \times 10^{-3}$ m <sup>3</sup> develops 100			
		kW brake power and consumes 33 kg of			
		petrol per hour of calorific value 44300			
		kJ/kg at 3000 rpm. Find: i) Brake mean			
		effective pressure, ii) Brake thermal			
		efficiency iii) Air standard efficiency (Take			
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One kg of petrol vapor occupies $0.26 \text{ m}^3$ at 1.013 bar and $150^\circ$ C. Take R for air as 287 J/kg K.UNIT-II3a)Explain the fuel requirements for both SI and CI engines.L2CO1, CO27 M CO2b)Describe the factors influencing delay period and knocking in CI engines.L2CO27 MOR4a)Distinguish the phenomenon of knocking in SI and CI engines.L2CO25 Mb)What are different stages of combustion in SI engines? Explain with p-0 diagram.L2CO29 MUNIT-III5a)What is regeneration? Draw the schematic and T-s diagrams for an ideal regenerative cycle.L3CO37 Mb)In a steam power plant operating on an ideal Rankine cycle, the steam enters the turbine at 3 MPa and 400°C and it is exhausted at 10 kPa. Determine (i) thermal efficiency (ii) thermal efficiency, if the steam is superheated to $500^\circ$ C at 3 MPa, before it enters the turbine at 10 MPa and 400°C.JMaJMa			$\gamma$ as 1.4); and iv) Air-fuel ratio by mass.			
Image: 1.013 bar and 150°C. Take R for air as 287 J/kg K.   UNIT-II   3 a) Explain the fuel requirements for both SI and CI engines. L2 CO1, 7 M CO2   b) Describe the factors influencing delay period and knocking in CI engines. L2 CO2 7 M CO2   4 a) Distinguish the phenomenon of knocking in L2 CO2 5 M SI and CI engines. CO2 9 M SI engines? Explain with p-θ diagram.   5 a) What are different stages of combustion in SI engines? Explain with p-θ diagram. L3 CO3 7 M co3 7 M co3 7 M co3 7 M co3 8 CO3 8 CO3 7 M co3 8 CO3 8 CO3 8 CO3 7 M co3 8 C			Assume a volumetric efficiency of 80%.			
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UK		1	OR	1	11	

6	a)	Explain briefly the methods to improve	L2	CO3	4 M		
0	<i>a)</i>	thermal efficiency of Rankine cycle.	L	005	<b>- IVI</b>		
	<b>b</b> )		1.2	CO3	10 M		
	b)	1	L2	COS	10 101		
		plant, operating on Rankine cycle, at 10					
		bar,300°C.The condenser pressure is 0.1					
		bar.Steam leaving the turbine is 90% dry.					
		Calculate the adiabatic efficiency of the					
		turbine and also the cycle efficiency,					
		neglecting the pump work.					
	1	UNIT-IV					
7	Exp	plain briefly the following types of jet	L2	CO4	14 M		
	con	densers:(i) parallel-flow type (ii) counter-					
	flov	w type (iii) ejector flow type					
	•	OR					
				~ ~ .			
8	a)	Discuss the merits and demerits of surface	L2	CO4	4 M		
		condensers over jet condensers.					
	b)	Dry-saturated steam at a pressure 11 bar	L4	CO4	10 M		
		enters a convergent-divergent nozzle and					
		leaves at a pressure of 2 bar. The flow is					
		adiabatic and frictionless, and neglects the					
		inlet velocity of steam. If the isentropic					
		specific enthalpy drop between inlet and					
		exit is 180 KJ/kg, what will be the exit					
		velocity of steam?					
	UNIT-V						
9	a)	Derive the thermal efficiency of Brayton	L4	CO4	7 M		
		cycle in terms of pressure ratio and					
		cycle in terms of pressure ratio and					

	b)	A constant pressure open cycle gas turbine plant works between temperature range of 15°C and 700°C and pressure ratio of 6. Find the mass of air circulating in the installation, if it develops 1100 kW. Also	L2	CO4	7 M
		find the heat supplied by the heating			
		chamber.			
	<b></b>	OR	<b></b>		
10	a)	Differentiate between closed cycle and	L2	CO4	4 M
		open cycle gas turbine plants.			
	b)	In an air-standard regenerative gas turbine	L4	CO4	10 M
		cycle, the pressure ratio is 5. Air enters the			
		compressor at 1 bar, 300 K and leaves at			
		490 K. The maximum temperature in the			
		adiabatic cycle is 1000K. Calculate the			
		cycle efficiency, given that the efficiency of			
		the regenerator and the adiabatic efficiency			
		of the turbine are each 80%. Assume for			
		air, the ratio of specific heats is 1.4. Also			
		-			
		show on T-s diagram.			